

P5366a

09/726,801

Response Under 37 CFR §1.116

AMENDMENTS TO CLAIMS:

The listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A method of identifying a target pattern in an image, said method comprising:

a) establishing an inventory of characteristic pattern points within said target pattern and establishing a first record of relative distances between selected characteristic pattern points, said relative distances being recorded as the square of the actual distances between said selected characteristic pattern points;

b) partitioning said image into a plurality of sub-image points;

c) identifying at least two sub-image points having attributes substantially similar to a corresponding two of said characteristic pattern points;

d) ~~calculating the square of the distance between said identified two sub-image points without determining the true distances between said identified two sub-image points, and comparing said calculated square to the recorded relative distance of said corresponding two characteristic pattern points, whereby the calculation of the square root of the square of the distance between said identified two sub-image points is avoided;~~

e) determining that said target pattern has not been identified in response to no match being found in step (d);

wherein step(a) further includes:

grouping characteristic pattern points into three-point sets defining a first angle having a characteristic pattern point at a vertex and two characteristic pattern points at side-ends of said first angle, the square of the distance between said vertex and each of the side-ends being part of said first record;

establishing a second record of first angle parameters proportional to a corresponding first angle within said three-point sets;

P5366a

09/726,801

Response Under 37 CFR §1.116

assigning an identification indicator to all three characteristic pattern points in each three-point set specifying which characteristic pattern point is at the vertex position and which are at either of the side-end positions of said first angle;

each first angle parameter being defined as the product of its corresponding first angle's side-lengths multiplied by the cosine of its corresponding first angle;

wherein said identified sub-image points are given the identification indicator of their correspondingly matched characteristic pattern points, and further including:

f) calculating a second angle parameter of a second angle defined by three identified sub-image points corresponding to a complete three-point set of characteristic pattern points, the vertex of said second angle being the sub-image point whose identification indicator corresponds to the characteristic pattern point that is the vertex of said first angle; and comparing said second angle parameter with said first angle parameter of said corresponding three-point set;

wherein said sub-image points forming the side-ends of said second angle are defined by X,Y coordinates of a cartesian plane having positional value relative to the sub-image point identified as the vertex of said second angle; said second angle parameter being defined as the sum of the product of the X coordinates and the product of the Y coordinates of said sub-image points at the side-ends of said second angle.

2. (Currently Amended) The method of claim 1, wherein ~~said sub-image points are distinguished by corresponding X,Y coordinates of a cartesian plane and the calculation of step (d) includes summing the square of the difference between respective X coordinates of said two identified sub-image points and the square of the difference between respective Y coordinates of said two identified sub-image points.~~

3. (Original) The method of claim 1, wherein selected characteristic pattern points whose relative distances constituting said first record have an associated identification indicator identifying them as a recorded two-point set, said

P5366a

09/726,801

Response Under 37 CFR §1.116

identified sub-image points being given the identification indicator of their correspondingly matched characteristic pattern points, and the square of the distance between said identified sub-points being calculated in step (d) only when their given identification indicator indicates that their corresponding characteristic pattern points are part of the same two-point set.

4. (Cancelled)

5. (Currently Amended) The method of claim 4-1 wherein said identified sub-image points are given the identification indicator of their correspondingly matched characteristic pattern point, and step (d) is implemented only when said identified sub-image points correspond to a complete three-point set.

6. (Cancelled)

7. (Currently Amended) The method of claim 61, further including:

g) determining that said pattern has been identified in response to said second angle parameter matching said first angle parameter and the square of the distance of the side-ends of said second angle matching the square of the distance of the side-ends of said first angle.

8. (Cancelled)

9. (Original) The method of claim 1 wherein each sub-image point is defined as a plurality of picture elements of said image.

10. (Original) The method of claim 9 further including combining the image information of said plurality of picture elements in each sub-image point into a representative composite, and comparing said composite to said characteristic pattern points.

11. (Currently Amended) A method of identifying a target pattern in an image, said method comprising:

a) establishing an inventory of characteristic pattern points within said target pattern;

P5366a

09/726,801

Response Under 37 CFR §1.116

b) grouping said characteristic pattern points into three-point sets defining a first angle having a characteristic pattern point at a vertex of said first angle and two characteristic pattern points at side-ends of said first angle, assigning an identification indicator to all three characteristic pattern points in each three-point set specifying which pattern point is at the vertex position and which pattern points are at the side-end positions of said first angle;

c) establishing a first record of a respective first angle parameter proportional to a corresponding first angle within each three-point set, each first angle parameter being defined as the product of its corresponding first angle's side-lengths multiplied by the cosine of its corresponding first angle;

d) partitioning said image into a plurality of sub-image points;

e) identifying at least three sub-image points having attributes substantially similar to a corresponding three of said characteristic pattern points;

f) calculating a second angle parameter characteristic of a second angle defined by said three identified sub-image points, and comparing said second angle parameter to said first angle parameters;

g) determining that said target pattern has not been identified in response to no match being found in step (f)

wherein:

step (e) includes assigning said identified sub-image points the identification indicator of their corresponding characteristic pattern point, and step (f) is implemented only when said identified sub-image points correspond to a complete three-point set;

said vertex of the second angle calculated in step (f) is the sub-image point whose identification indicator corresponds to the characteristic pattern point that is the vertex of the corresponding complete three-point set; and the calculated second angle parameter is compared with the first angle parameter of said corresponding three-point set; and

said sub-image points forming the side-ends of said second angle are defined by X,Y coordinates of a cartesian plane having positional value relative

P5366a

09/726,801

Response Under 37 CFR §1.116

to the sub-image point identified as the vertex of said second angle; said second angle parameter being defined as the sum of the product of the X coordinates and the product of the Y coordinates of said sub-image points at the side-ends.

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Currently Amended) The method of claim ~~13~~11, wherein the three characteristic pattern points of each three-point set constitute a triangle and said method includes determining a separate first angle parameter for each of the three angles of said triangle; and

said step (f) further including calculating said second angle parameter for each of the three angles formed by said identified three sub-image points, and comparing the three calculated second angle parameters with their corresponding three first angle parameters; and

said step (g) includes determining that said target pattern has been identified in response to all three second angle parameters matching their corresponding three first angle parameters.

16. (Currently Amended) The method of claim 11, wherein the three characteristic pattern points of each three-point set constitute a triangle and step (c) further includes establishing a second record of first length parameters defined as the square of the distances between the characteristic pattern points forming the sides of said triangle; and

step (f) further includes calculating a second length parameter defined as the square of the distances between said identified three sub-image points in correspondence to the sides of said triangle defined by their corresponding three-point set ~~without determining the true distances between said identified three sub-image points~~, and comparing said second length parameters to their corresponding first length parameters, ~~whereby the calculation of the square root~~

P5366a

09/726,801

Response Under 37 CFR §1.116

~~of the square of the distance between said identified three sub-image points is avoided.~~

17. (Original) The method of claim 16 wherein step (g) further includes determining that said target pattern has been identified in response to two of said second length parameters matching their respective first length parameters and said second angle parameter matching its respective first angle parameter.

18. (Original) The method of claim 16 wherein said method includes determining a separate first angle parameter for each of the three angles of said triangle; step (f) includes calculating second angle parameters for the angles defined by said three identified sub-image points; and step (g) further includes determining that said target pattern has been identified in response to two of said second angle parameters matching their corresponding first angle parameters and at least one of said second length parameter matching its respective first length parameter.

19 (Currently Amended) The method of claim 16 wherein ~~said sub-image points are distinguished by corresponding X,Y coordinates of a cartesian plane and the calculation of said second length parameters includes summing the square of the difference between respective X coordinates of two corresponding sub-image points and the square of the difference between respective Y coordinates of said two corresponding sub-image points.~~

20. (Currently Amended) A pattern recognition system for identifying a target pattern within an image, said pattern recognition system comprising:

a memory store holding first key data descriptive of selected characteristic pattern points within said target pattern, said characteristic pattern points being grouped into three-point sets constituting a first triangle, said first key data including at least one of first length attribute data and first angle attribute data, said first length attribute data being the square of the sides of said first triangle, said first angle attribute data corresponding at least to one of the three angles within said first triangle and being the cosine of a first angle multiplied by the length of the sides adjoining said first angle;

P5366a

09/726,801

Response Under 37 CFR §1.116

a processing unit having access to said memory store and having an input for receiving second key data descriptive of selected sub-image points of said image, said selected sub-image points having image attributes substantially similar to corresponding characteristic pattern points and said second key data including position information of its corresponding sub-image point, said processing unit collecting said second key data into data groups corresponding to three sub-image points constituting a second triangle and using said position information to calculate at least one of second length attribute data and second angle attribute data distinctive of said second triangle, said processing unit comparing available second length attribute data to available first attribute data and comparing available second angle attribute data to available first angle attribute data to determine whether said second triangle is congruent to said first triangle;

wherein said processing unit includes a calculation unit producing said second length attribute data and said second angle attribute data, said calculation unit identifying the relative positions of each said sub-image points in said second triangle as X,Y displacement coordinates of a cartesian plane relative to a chosen sub-image point of said second triangle, said second length attribute data being calculated as the square of a side of said second triangle; and

wherein the second angle attribute data of a chosen angle coincident with said chosen sub-image point being calculated as the sum of the product of the X displacement coordinates and the product of the Y displacement coordinates of the two sub-image points defining the sides of said second triangle adjacent said chosen angle.

21. (Cancelled)

22. (Currently Amended) The pattern recognition system of claim ~~21~~20, wherein said group of three sub-image points corresponds to a complete three-point set of characteristic pattern points such that said second triangle of selected sub-image points corresponds to a specific first triangle of characteristic

P5366a

09/726,801

Response Under 37 CFR §1.116

pattern points, and said processing unit further compares each second triangle only to its corresponding first triangle.

23. (Original) The pattern recognition system of claim 22, wherein said processing unit determines that said second triangle is congruent to said first triangle in response to the second length attribute data of said second triangle's three sides matching the first length attribute data of said first triangle's three sides.

24. (Original) The pattern recognition system of claim 22, wherein said processing unit determines said second triangle is congruent to said first triangle in response to at least one second angle attribute data value matching one first angle attribute data value and two second length attribute data values matching two first length attribute data values.

25. (Original) The pattern recognition system of claim 22, wherein said processing unit determines said second triangle is congruent to said first triangle in response to three second angle attribute data values matching three first angle attribute data values.

26. (Original) The pattern recognition system of claim 20, wherein said memory store further holds an identifying indicator specifying the three-point set to which each characteristic point belongs, said pattern recognition system further including:

a pattern matching unit receiving sub-image point data of said image and comparing said sub-image point data to said characteristic pattern point data, said pattern matching unit flagging each sub-image point data that substantially matches a characteristic pattern point data and assigning it the identifying indicator of its correspondingly matched characteristic pattern point data, said flagged sub-image point data being part of said second key data.

27. (Original) The pattern recognition system of claim 26, wherein said processing unit groups said second key data into groups of three sub-image points corresponding said three-point sets as determining by said identifying

P5366a

09/726,801

Response Under 37 CFR §1.116

indicator, the calculation of said second length attribute data and said second angle attribute data being conducted only on groups of selected sub-image points that constitute a complete three-point set.